suffice to give the most successful student a high place in the Cambridge list of Wranglers. No doubt, in the near future, English girls all over the land will have as few obstacles in the way of their higher education as English boys.

MR. H. T. WOOD, of the Society of Arts, writing to Col. Donnelly, of the Science and Art Department, South Kensington, informs him that sufficient funds will be provided by the City Companies for the payment of teachers of classes for instruction in technology, on the same scale as that on which teachers of science classes are now paid by the Science and Art Department, and without any proportionate reduction, as stated in the Society's Programme of Examinations (p. 14), on the ground that all the amount at the disposal of the Society might be insufficient to allow of the full payment in all cases. Mr. Wood asks that this important fact be brought under the notice of the Secretaries of Science Classes and Schools. The arrangement will apply to the examinations held in May next.

DR. T. LAUDER BRUNTON, who was recently appointed to the Thomson Lectureship in the Aberdeen Free Church College, delivered the opening lecture on Monday, the 3rd inst. The course will consist of ten lectures.

THE University Library at Strassburg, founded after the recent Franco-German War, numbered no less than 470,000 volumes at the end of 1878.

WE are glad to see that in the second number of the *University College of Wales Magazine* science finds a corner in the shape of "Museum Notes." One of these, by Prof. Rudler, is a brief *résumé* of what is known of the Moa, *apropos* of a collection of moa-bones in the College Museum.

SCIENTIFIC SERIALS

Journal of the Franklin Institute, January.—The error of some wild statements made about the size and cost of the cable that would be needed to convey the power of Niagara Falls several hundred miles by electricity is here shown by Professors Thomson and Huston, who calculate, *e.g.*, that 1,500 to 3,000 horse-power could be conveyed 1,000 miles (50 per cent. out of 3,000 horse-power) with a copper cable about ¼ inch in thickness. Less than ½ inch would suffice for 500 m. For consumption of 1,000,000 horse-power a 3-inch cable would suffice. The same authors describe a curious thermo-magnetic motor, and an induction apparatus for reversed currents.—Dr. Henry Morton finds the coating of the "luminous clocks" sulphide of calcium attached with some resinous medium, and seems hopeful that advances in this direction may by and by give us houses lit at night by phosphorescent walls.—Mr. Huston gets some remarkable effects (needing confirmation from repeated tests) in subjecting iron to a continued and constantly increasing strain.—Dr. Dudley considers toughness, rather than hardness, the essential quality for durability of steel rails.—An automatic machine for playing the game of tit-tat-to is described by Mr. Freeland.

Reale Istituto Lombardo di Scienze e Lettere, vol. xi. fasc. xix., xx.—On some derivatives of ethyl-paraoxybenzoic aldehyde, by S. Corbetta.—The English sanitary laws, by Dr. Zucchi.—On the use of salts of berberine as febrifuge, and on tumours of the spleen from malarian infection, by Dr. Zucchi.—Studies on milk at the Pavian laboratory of cryptogamic botany, by Drs. Pirotta and Riboni.—Value of two meteorological instruments of Bellani, by Prof. Cantoni.—Observations on the seismic microphone of De Rossi, by Prof. Cantoni.

Vol. xii. fasc. i.—Studies on milk (continued), by Drs. Pirotta and Riboni.—New physio-pathological researches on pulmonary phthisis, by Prof. de Giovanni.—First lines of introduction to the study of the Italian bacteria, by S. Trevisan.—On modular equations, by S. Klein.—On pentahedral equations of surfaces of the third order, by Prof. Beltrami.

Bulletin de l'Académie Royale de Belgique, No. 11, 1878.—Besides M. Montigny's paper on variations in the scintillation of stars (referred to last week), this number contains a valuable memoir by M. Fredericq on the organisation and physiology of the poulpe (or octopus), which he studied at the laboratory of Roscoff. The arterial blood yields a blue colouring matter (called *hæmocyanine*), which corresponds somewhat to hæmoglobin, but contains copper, not iron. Both respiration and nutrition of tissues depend on it. The heart has both accelerating and moderating nerves. The blood pressure is considerably greater than in cold-blooded vertebrates; the venous system shows rhythmic contraction; exterior water does not mix with the blood; the urine contains neither urea nor uric acid, but a substance like guanine, &c. M. Fredericq localises the centres of the respiratory movements, and gives some interesting observations on the "chromatic function."—M. Van der Mensbrugghe finds confirmation of his theory of the variations of potential energy of liquid surfaces, in some peculiarities of liquid sheets, which he accounts for on thermodynamical principles.—M. Lienard communicates researches on the structure of the digestive apparatus of Mygales and Nephiles, and M. Longchamps concludes his synopsis of the Gomphines.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, January 30.—"On the Effects of Heat on the Di-iodide of Mercury, HgI_2," by G. F. Rodwell, Science Master, and H. M. Elder, a pupil, in Marlborough College.

The authors, in continuation of experiments of a similar character previously communicated by one of them to the Society, on the anomalous expansion of the iodide of silver, have examined the iodide of mercury with a view to the detection of similar anomalies. This body is dimorphous, existing in the form of yellow prismatic crystals, which change under external mechanical influence, or during the process of cooling, to brilliant scarlet octohedrons with a truncated summit. The mass melts at 200° C. to a red-brown liquid, which volatilizes at a slightly higher temperature. The following volumes were determined at the temperatures given:—

	Volume.		Specific Gravity
Liquid at 200° C.	1·1191147	...	5·286
Solid ,, ,, ...	1·0190453	...	6·179
Yellow prismatic condition at 126° C.	1·0115378	...	6·225
Red octohedral condition at 126° C.	1·0043337	...	6·276
,, ,, ,, at 0° C.	1·0000000	...	6·297

Thus the di-iodide of mercury possesses one coefficient of expansion = ·0000344706 for 1° C. between 0° and 126° C., it then undergoes a sudden expansion = ·00720407 in changing from the red octohedral to the yellow prismatic variety, while between 126° C. and the melting-point (200° C.), it expands under a higher coefficient than before = ·0001002953 for 1° C.

"A Comparison of the Variations of the Diurnal Range of Magnetic Declination as recorded at the Observatories of Kew and Trevandrum." By Balfour Stewart, F.R.S., Professor of Natural Philosophy in Owens College, Manchester, and Morisabro Hiraoka.

1. Generally speaking, maximum points or risings in the one curve must be associated with maximum points or risings in the other, rather than with minimum points or depressions. Indeed, the researches of Broun and others, from a different point of view, strengthen this conclusion, which is, however, abundantly supported by a glance at the curves themselves.

2. The oscillations of the Trevandrum curve are greater than than those of the Kew curve.

3. In many cases where there is a want of striking likeness between the oscillations of the two curves, there are yet noticeable traces in the one curve corresponding to the oscillations of the other. There are, however, a few cases where there is a want of apparent likeness.

4. In general, though not invariably, the oscillations of the Trevandrum curve follow rather than precede the corresponding oscillations of the Kew curve.

February 6.—"Absorption of Gases by Charcoal. Part II. On a new Series of Equivalents or Molecules." By R. Angus Smith, Ph. D., F.R.S.

In the *Transactions* of the British Association, 1868, Norwich, on p. 64 of the "Abstracts," there is a preliminary notice of an investigation into the amount of certain gases absorbed by charcoal. I made the inquiry from a belief previously expressed in a paper of which an abstract is in the *Proceedings* of the Royal Society, p. 425, for 1863. I said in that paper that the action of the gas and charcoal was on the border line between physics and chemistry, and that chemical phenomena were an extension of the physical; also that the gases were absorbed by charcoal in whole volumes, the exceptions in the numbers being supposed to be mistakes. The results given were:—

Hydrogen	1
Oxygen	7·99
Carbonic oxide	6·03
Carbonic acid	22·05
Marsh-gas	10·01
Nitrous oxide	12·90
Sulphurous acid	36·95
Nitrogen	4·27

It was remarked that the number for nitrogen was probably too low; I had some belief that the charcoal retained a certain amount which I had not been able to estimate.

For common air, the number 40·065 crept into the paper or abstract instead of the quotient 7·06.

I considered the numbers very remarkable, but was afraid that they would be of little interest unless they could be brought more easily under the eyes of others; my experiments were somewhat laborious; the exact numbers were seldom approached by the single analysis, but were wholly the result of a series of irregular averages and apparently irregular experiments. The cause of this was clear, as I believed, namely, the irregular character of the charcoal with which I had to deal. The experiments were forgotten, I suppose, by most men, but the late Prof. Graham told me that he had repeated them with the same results that I had published. I might have considered this sufficient, but waited for time to make a still more elaborate investigation of the subject, and to take special care with oxygen, in the belief that, the rule being found, the rest of the inquiry would be easy; this was extended to nitrogen, but not by so many experiments as with oxygen. I am now assured of a sound foundation for inquiries, which must take their beginning from the results here given.

It is found that charcoal absorbs gases in definite volumes, the physical action resembling the chemical.

Calling the volume of hydrogen absorbed 1, the volume of oxygen absorbed is 8. That is, whilst hydrogen unites with eight times its weight of oxygen to constitute water, charcoal absorbs eight times more oxygen by volume than it absorbs hydrogen. No relation by volume has been hitherto found the same as the relation by weight.

The specific gravity of oxygen being 16 times greater than hydrogen, charcoal absorbs 8 times 16, or 128 times more oxygen by weight than it does hydrogen. This is equal to the specific gravity of oxygen squared and divided by two $\frac{16^2}{2}$, or it is the atomic weight and specific gravity multiplied into each other, 16×16, and divided by two $\frac{256}{2} = 128$.

Nitrogen was expected to act in a similar way, but it refused. The average number of the latest inquiry is 4·52, but the difficulty of removing all the nitrogen from charcoal is great, and I suppose the correct number to be 4·66. Taking this one as the weight absorbed, $14 \times 4{\cdot}66 = 65{\cdot}3$, or it is $\frac{14^2}{3}$. Oxygen is a dyad; nitrogen a triad.

We have then carbonic acid not divided, but simply 22 squared = 484.

Time is required for full speculation, but the chemist must be surprised at the following:—

Carbonic oxide	6 volumes.	
Carbonic acid, CO_2	6 + 16 ,,	= 22.
Marsh-gas, CH_4	6 + 4 ,,	= 10.
Protoxide of nitrogen, NO	8 + 4·66 (N) (4·9).	= 12·66.

These four results belong to the early group not corroborated lately, but so remarkably carrying out the principle of volume in this union giving numbers the same as those of weight in chemical union, that they scarcely require to be delayed.

I am not willing to theorise much on the results; it is here sufficient to make a good beginning. We appear to have the formation of a new series of molecules made by squaring our present chemical atoms, and by certain other divisions peculiar to the gases themselves. Or it may be that the larger molecule exists in the free gas, and chemical combination breaks it up. These new and larger molecules may lead us to the understanding of chemical combinations in organic chemistry and whenever there is union not very firm, and may also modify some of our opinions on atomic weights and the motion of gases.

Of course, I cannot pretend to give the result of these results; but as we have here the building up of a molecule by volumes, so as to form an equivalent of physical combination analogous to the chemical equivalent, it is impossible to avoid seeing that it indicates the possibility of our present equivalents being made up in a similar manner.

I did not expect these numbers; but I certainly, as my previous paper showed, had in full view a necessity for some connection between physical and chemical phenomena more decided than we possessed.

Chemical Society, February 6.—Dr. Gladstone, president, in the chair.—This meeting was occupied by the discussion on the processes for determining the organic purity of potable waters, a paper read by Prof. Tidy some time since. Dr. Frankland opened the discussion and criticised at some length the objections urged by Prof. Tidy against his method of estimating the carbon and nitrogen in a water residue by combustion. The discussion was continued by Mr. Wanklyn, Mr. Kingzett, Prof. Bischof, Dr. Voelcker, Mr. Grosjean, Dr. Dupré, Mr. W. Thorp, and Dr. Hake. Prof. Tidy then briefly replied, and the proceedings terminated with a unanimous vote of thanks from a crowded meeting to Prof. Tidy for his paper.

Zoological Society, February 4.—Dr. Günther, F.R.S., vice-president, in the chair.—Mr. Sclater exhibited and made remarks on a specimen of a Curassow, belonging to the Royal Museum of Copenhagen, which he had received from Prof. J. Reinhardt, F.M.Z.S., for examination, and which Prof. Reinhardt had proposed to refer to a new species (*Mitua salvini*).—Mr. R. Bowdler Sharpe exhibited a series of Bulwer's Pheasant (*Lobiophasis bulweri*), from the Lawas River, N.W. Borneo, collected by Mr. W. H. Treacher, Acting-Governor of Labuan. The series represented every stage of plumage of this pheasant, and conclusively proved that *L. castaneicaudatus*, Sharpe, was the immature male of *L. bulweri*.—A communication was read from Prof. A. H. Garrod, F.R.S., containing some notes on certain points in the anatomy of Hoatzin (*Opisthocomus cristatus*).—Mr. Sclater read some notes on the breeding of the Argus Pheasant and other Phasianidæ in the Society's Gardens.—A communication was read from the Rev. O. P. Cambridge, C.M.Z.S., containing the description of a new genus and species of spiders, proposed to be called *Fritzia muelleri*.—Mr. W. Ottley read the firs part of a series of observations on the structure of the eye-muscles in the mammalia.—A communication was read from Mr. Osbert Salvin, F.R.S., on some birds transmitted by the Rev. Thomas Powell from the Samoan Islands, amongst which were two new species proposed to be called *Pinarolestes powelli* and *Fregetta mæstissama*.—A communication was read from Mr. W. H. Dale containing remarks on the use of the generic name *Gouldia* in zoology.—Mr. George A. Shaw read notes upon the habits of four species of Lemurs, specimens of which had been brought alive to England in 1878, from the province of Betsileo in Central Madagascar.—A communication was read from Mr. F. Moore, F.Z.S., containing descriptions of some new Asiatic diurnal lepidoptera.—Dr. A. Günther, F.R.S., pointed out the characters of a new rodent from Medellin, U.S. of Columbia, for which the name *Thrinacodus albicauda* was proposed.

Linnean Society, January 16.—Mr. W. Carruthers, F.R.S., vice-president, in the chair.—Prof. Allen Thomson exhibited and made some remarks on a block of wood, during the growth of which a portion of the shank-bone of an ox had become centrally inclosed; he also called attention to an imperfect frond of a palm (Chæmærops?) asserted to have been discovered within a plank of rosewood.—Mr. Christy in some observations referred to the Chalmugra tree (*Gynocardia odorata*), its therapeutical properties being highly extolled, especially in rheumatism.—Mr. J. G. Baker read a paper on the Colchicaceæ and aberrant tribes of Liliaceæ. Colchicaceæ is the smallest of the three sub-orders of Liliaceæ, it includes 39 genera and 153 species. Its geographical dispersion agrees completely with true Liliaceæ. In its typical form it is marked by extrorse anthers, a septicidal capsule, and three distinct styles; but as 24 out of 39 genera do not possess all these three characters in combination, but recede more or less decidedly from the type in the direction of true Liliaceæ, it seems injudicious to follow those who have proposed to keep up Colchicaceæ or Melanthaceæ as a distinct natural order. Mr. Baker defines seven tribes, Colchiceæ, Merenderæ, Veratreæ, Anguillareæ, Helonieæ, Uvularieæ, and Tofieldieæ. There are several anomalous genera of the Colchicaceæ, for instance Hewardia, which connects the Liliaceæ with the Iridaceæ. Again, there are three aberrant tribes of Liliaceæ, viz., (1) Conantheræ a connecting link between Liliaceæ and Amaryllidaceæ, (2) Liriopeæ

(formerly Ophiogon) and (3) Gilliesieæ; genera among the two latter receding widely from the liliaceous type and others bridging over the interval between the extreme form and ordinary lilies. The author then enters into lengthened descriptions with ample diagnosis, &c., forming in fact a valuable continuation of his former series of monographs of the natural order of Liliaceæ.—Messrs. G. Brook, A. P. Luff, J. E. Griffiths, C. Sharp, and J. Woodland, were balloted for and elected Fellows of the Society.

Anthropological Institute, January 28.—Anniversary Meeting.—Mr. John Evans, D.C.L., F.R.S., president, in the chair.—The election of Mr. A. H. Keane, B.A., as a Member was announced.—The following gentlemen were elected to serve as officers and council for the year 1879. President—E. B. Tylor, F.R.S. Vice-Presidents — Hyde Clarke, J. Evans, F.R.S., Prof. Flower, F.R.S., Maj-Gen. A. Lane Fox, F.R.S., Francis Galton, F.R.S., Prof. Rolleston, F.R.S. Directors and Hon. Secretaries.—E. W. Brabrook, F.S.A., W. L. Distant, J. E. Price, F.S.A. Treasurer—F. G. H. Price, Esq., F.R.G.S. Council—Lt.-Col. Goodwin Austen, J. Beddoe, F.R.S., Prof. George Busk, F.R.S., C. H. E. Carmichael, M.A., J. Barnard Davis, Esq., F.R.S., W. Boyd Dawkins, F.R.S., Capt. Harold Dillon, F.S.A., A. W. Franks, Esq., F.R.S., J. Park Harrison, M.A., Prof. Huxley, F.R.S., A. L. Lewis, Sir J. Lubbock, Bart., M.P., R. Biddulph Martin, F. W. Rudler, F.G.S., C. R. Des Ruffières, F.R.S.L., Lord Arthur Russell, M.P., Rev. Prof. Sayce, M.R.A.S., Dr. Allen Thomson, F.R.S., C. Staniland Wake, M. J. Walhouse, F.R.A.S. The retiring president delivered his annual address, in the course of which he alluded to the researches now being carried on in the caves of Borneo by Mr. Everett (see p. 352).

Geological Society, January 22.—Henry Clifton Sorby, F.R.S., president, in the chair.—John Edward Marr and Lieut. Henry Tryon Wing were elected Fellows of the Society.—The following communications were read:—On community of structure in rocks of dissimilar origin, by Frank Rutley.—Distribution of the serpentine and associated rocks, with their metallic ores, in Newfoundland, by Alexander Murray.

Institution of Civil Engineers, February 11.—Mr. W. H. Barlow, F.R.S., vice-president, in the chair.—The following papers were read:—On the Geelong water supply, Victoria, Australia, by Mr. Edward Dobson, Assoc. Inst., C.E.—On the Sandhurst Water Supply, Victoria, Australia, by Mr. Joseph Brady, M. Inst. C.E.

Victoria (Philosophical) Institute, February 3.—A paper on the Torquay caves was read by Mr. J. E. Howard, F.R.S., in which he reviewed the reports given by geologists who had excavated and examined the various deposits in these caves. Mr. Howard examined into the nature of these deposits and the conditions under which they must have taken place, and pointed out the peculiar nature of the evidence by which it was possible to arrive at some conclusion as to the age of those deposits. Prof. Challis, F.R.S., and others took part in the discussion, either by sending communications to be read or by attending to do so.

PARIS

Academy of Sciences, February 3.—M. Daubrée in the chair.—The following papers were read:—Remarks on the third reply of M. Pasteur, by M. Berthelot.—On the development of the perturbative function, &c. (continued), by M. Tisserand.—On the fermentation of cellulose, by M. van Tieghem. The author gives observations on amylobacter, the figured ferment of cellulose. It affects different plant tissues differently; only in the young state have all the cells of all plants their membranes equally dissolved by it. The results have a physiological bearing (digestibility of cellulose from different plants), and a palæontological (unequal chances of fossilisation of different plants). The amylobacter first transforms soluble starch into dextrine, then into glucose, and it is really the glucose that ferments. It seems to be by direct contact of amylobacter with cellulose that the latter is dissolved, not through a diastase of cellulose acting without at a distance.—On the construction of the international geodetic scale, by MM. Sainte-Claire Deville and Mascart.—An account of the physical and chemical properties of the scale (of iridised platinum) prepared by Johnston and Matthey, and of experiments to determine the coefficient of dilatation of a thermometric tube made of the material.—On the invention of several arrangements of the heliometer, by M. De la Gourmerie. He attributes the half objectives not to Dollond but to Bouguer, considered the original inventor of the heliometer.—M. Cosson called attention to a case of fire in the laboratory of his herbarium, arising from carbonisation of boards of flooring exposed to hot air from an air-hole fed from a stove 4 m. off on the floor below.—M. de Lesseps presented a fourth volume of his "Letters, Journal, and Documents to serve for the History of the Suez Canal." He quoted a long letter he had addressed to Mr. Layard, vindicating the enterprise against opposition then offered.—M. Lalanne was elected Free Member in room of the late M. Bienaymé.—On the conditions of existence of a determinate number of roots common to two given equations, by M. Simonnet.—On some invariants of linear differential equations, by M. Laguerre.—On the motion of a body which is displaced and deformed while remaining homothetic with itself, by M. Fouret.—Integration, in finite form, of three species of linear differential equations with any coefficients, by M. André.—Extension of the metric system of weights and measures; development of concordant monetary systems in the various states of the civilised world, by M. de Malarce. The metric system of weights and measures is now established obligatorily in eighteen states, with 236·6 millions of inhabitants; it is legally optional in three states with 75·5 millions; and it is admitted in principle, or partially for customs, in five states, with 343·6 millions.—Liquefaction of siliciated hydrogen, by M. Ogier. It is liquid at − 11° under 50 atm.; at − 1° under 100 atm. At zero it remains gaseous up to 150 and 200 atm.—Memoir on the determination of methylic alcohol in commercial methylenes, by MM. Bardy and Bordet.—Influence of duration and intensity on luminous perception, by MM. Richet and Breguet. A weak light, perceived distinctly when it impresses the retina some time, becomes invisible when its duration diminishes. It may be rendered visible anew by making it more intense, or increasing its duration, or repeating it rapidly. Coloured lights are subject to the same laws, and are always seen with their proper coloration, whether strong or weak, long or short.—On the minute structure of the central nervous system of decapod crustaceans, by M. Yung.—On the Wagnerite of Bamle in Norway, and on a retinite of Russia, by M. Pisani.—The glazed frost of January, 1879, by M. Godefroy.—On the effects of the same at Fontainebleau, by M. Piebourg. This (somewhat rare) phenomenon did great mischief to trees, the greatly increased weight breaking down their branches, &c.

GÖTTINGEN

Royal Academy of Sciences, November 2, 1878.—The following, among other papers, were read:—On a propagation of the growth-stimulus produced by fertilisation on vegetative organs, by Herr Reinke.—Observations on the value of a ligature of the great brain-arteries, for experimental pharmacological researches, by Herr Marmé.

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